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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/766,036	01/29/2004	Christophe Chau	PET-2122	2439

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EXAMINER	
FORTUNA, ANA M	

ART UNIT	PAPER NUMBER
1723	

DATE MAILED: 05/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/766,036	CHAU ET AL.	
	Examiner	Art Unit	
	Ana M. Fortuna	1723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☒ Claim(s) *17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *1/29/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 1, 4, 5, are rejected under 35 U.S.C. 102(b) as being anticipated by Rao et al. (US 5,104,425). Rao discloses an inorganic membrane containing carbon distributed within the pores of the membrane or substrate (column 6, lines 20-56, column 8, lines 53-55). The substrate is disclosed as asymmetric, inorganic; the use of asymmetric commercially available substrate is also disclosed by Rao (column 3, lines 59-66, column 8, lines 23-44). The membrane product of Rao is disclosed as either asymmetric or layered, and in particular asymmetric is referred for the embodiment where the pores are filled with the carbon (see column 8, lines 40-45). The substrate membrane in the "composite" (carbon within the substrate membrane) is disclosed as having a porosity of 20 % (column 12, lines 50-53); since the pores of the final membrane are covered or filled with the carbon, the final membrane of Rao includes a percentage of 20 % of carbon. The increasing or decreasing distribution of carbon within the membrane pores seems to be inherent based on the substrate membrane asymmetric structure, with an inherent small percentage of carbon within the membrane with lower pore size, and a larger amount in the section of the asymmetric membrane

with the larger pore size. Rao teaches that the pores on the membrane or substrate are within the range of 0.2 to 50 microns (column 12, lines 23-27).

Regarding claim 4, Rao discloses the base membrane or substrate is disclosed as graphite, ceramic, carbonaceous, metallic, can be made from the same adsorptive material (carbon, alumina, silica, zeolite, or different material (column 10, lines 11-28, column 9, lines 31-35, column 12, lines 23-27, column 8, lines 63-64).

As to claim 5, asymmetrical membranes, disclosed in Rao, are inherently supported, e.g their structure includes a large pores integral support layer, and a skin layer, or area with the lower pore size.

Regarding claim 12-13, the use of the membrane is separation of hydrogen, C02, is disclosed in Rao (see tables 4 and 5-6, column 14, and column 15, lines 1-34).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 3, 6, 7, 8, 9, 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rao (US 5,104,425) or Rao in view of DeLiso et al (US 5,451,444). The membrane of claim 1 is discussed above. The distribution of the carbon in the graduated manner as claimed in claim 1 is not textually disclosed in Rao. It would have been obvious to one skilled in this art at the time the invention was made to expect a distinct distribution of the carbon within the membrane pore regions of the "asymmetric"

support of Rao, because the percentage of porosity or pore volume in an asymmetric membrane is lower at the membrane region with the smaller pore size (skin), as compared to the pore volume available in the (asymmetric) membrane supporting layer (area that support the region with smaller pore size). One skilled in the art can expect larger carbon amount provided within the region of larger pores, due to the asymmetry of the support.

Regarding claims 2-3, and 6-7, Rao teaches using asymmetric support commercially available, and made of inorganic material, as discussed in the paragraph above. Rao also teaches selecting an appropriate support, taking in consideration the carbon precursor dispersion properties, e.g the size of the polymeric beads in a dispersion used to produce the carbon (claim 19, columns 19-20, column 12, lines 48-58).

One skilled in this art at the time this invention was made can expect penetration of the carbon precursor having particles smaller than the pore size of the support, within the pores of the support. Selecting support with pore sizes within the values suggested in Rao, or smaller, based on the type of particles in the dispersion used to fill the membrane pores to generate the carbon compound. Optimization of the membrane of Rao, e.g. by selecting larger or smaller pores membrane support appears to be within the knowledge of the skilled in the art, based on Rao's teaching.

DeLiso et al teach porous filters made from inorganic porous substrate containing porous carbon within the pores of the substrate (abstract, column 2, lines 18-50). The process of forming the carbon within the pores of the substrate, the inorganic material

for the substrate including alumina, alumina silicates, silicates, etc are also disclosed (column 2, lines 54-68, column3, lines 1-36, and column 4, lines 24-66).

DeLiso et al teach the factors determining the final quantity of carbon within the pores of a substrate, e.g. the amount of carbon precursor retained by the substrate, as dependent of the substrate porosity, with a higher amount retained by increasing the porosity (column 4, lines 38-50); the viscosity of the carbon precursor, with the larger penetration of the carbon precursor into the roes of the substrate when the viscosity is low (column 4, last paragraph). DeLiso et al's teaching further support the theory of obviousness/ inherency discussed above, e.g. the gradual carbon distribution of carbon contain throughout the membrane thickness when asymmetric support is used, which support pore distribution was taught by Rao.

DeLiso et al further teaches providing the substrate with up to 50 % of carbon (see column 5, lines 54).

5. Claims 1-4, 8, 9,10, 11, 14, 15, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shadman (US 5,637,544), in view of Rao US 5,104,425), and DeLiso et al (US 5,451,444).

Shadman teaches an inorganic membrane including a porous inorganic support and carbon provided on the membrane surfaces abstract, column 2, lines 25-56), the support is a microporous membranes, made form alumina, etc (column 3, lines 47-68, column 4, lines 1-44). The percentage of carbon deposited or distributed within the membrane is not disclosed in Shadman. Shadman, however, teaches reducing the pores of the substrate from a pore diameter of 500 to 50 Angstrom, which suggest that

substantial amount of carbon have to be deposited within the membrane by reducing the pores at the level disclosed by Shadman, also teaches the pores of the substrate within the ranges claimed in claims 6 and 7 of the present invention, e.g. gamma-alumina membrane with pore sizes between 20 Angstrom and 100 Angstrom. One skilled in the art at the time the invention was made the membrane can achieve the same results in terms of carbon content, by selecting the same membrane pore size and degree of porosity, and further controlling the conditions during the CVD as suggested by Shadman.

Shadman further teaches the process of making the membrane, e.g. CVD (column 4, lines 45-68, and column 5, lines 5-6), and teaches controlling the thickness and amount of carbon to be deposited by adjusting the reaction time, temperature, gas composition and flow rate (column 4, lines 59-63). The carbon distribution of claim 1 is not disclosed in Shadman.

Rao, discussed above, suggests selecting an inorganic support with asymmetric structure.

DeLiso et al, discussed above, teaches the effect on pore size on amount of carbon retained by the membrane (substrate) within the pores.

It would have been obvious to one skilled in this art at the time this invention was made to select an asymmetric inorganic membrane support (which includes tow regions of pore size, e.g dense layer and skin layer), to produce a membrane containing regions or zones of different content of carbon, the percentage of retained carbon will be pore size dependent as disclosed in Shadman.

Although the patents above are directed to different processes of making or filing the pores of the substrate with carbon, one skilled in this art at the time this invention was made would have been predicted the a difference in carbon distribution, based on pore size, according to DeLiso 's disclosure (as discussed above). e.g larger pores should contain larger percentages of carbon.

Regarding claim 10-11, the temperature conditions of steps a) and b), and constant within the heating of step a), and during the heating step (b), e.g. 250 degree C, and 350-450 degree C are disclosed in Shadman (column 4, 56-63).

As to claim 14-16, Shadman teaches the membrane incorporating reactive sites, an producing oxidation, reduction reactions and suitable for gas separation, including hydrogen, CO2, etc (column 9, lines 17-33, column 7, lines 2-68, column 8, lines 1-15, and column 8, lines 24-60. Use as catalyst is not disclosed, however, one skilled in the art selecting zeolite as inorganic support, as suggested in Rao, can expect certain degree of catalytic reaction I operation with certain gas or mixtures.

Shadman teaches regarding claim 5, a membrane support or substrate as composite or supported (column 9, lines 28-31).

6. Claim 17 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter: the membrane including three regions with distinct carbon content as claimed in

claim 17 is not disclosed or suggested by the prior art of recode. Although asymmetric support is disclosed for the carbon containing membrane a degree of asymmetry including more than two layers, is not disclosed. The membrane of Shadman can include a top layer on top of the active sites, but does not include carbon on the top layer (see column 9,lines23-31).

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference 7,041,616 teaches inorganic membrane (e.g. porous zeolite), containing carbon within the pores. The percentage of carbon is not disclosed.

9. 6,214,204 teach porous support containing carbon. 6,767,384, and 6,486,373 teach zeolite membranes as catalysts.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ana M. Fortuna whose telephone number is (571) 272-1141. The examiner can normally be reached on 9:30-6:00 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wanda L. Walker can be reached on (571) 272-1151. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ana M Fortuna
Primary Examiner
Art Unit 1723

AF
May 17,2006